Title

Graphics Processing Unit Assisted Thermographic Compositing

Center Point of Contact

Scott Ragasa (256) 544 3935 joseph.s.ragasa@nasa.gov	Samuel S. Russell. (256) 544-4411 sam.russell@nasa.gov

Objective

Develop a software application utilizing high performance computing techniques, including general purpose graphics processing units (GPGPUs), for the analysis and visualization of large thermographic data sets

Background

Over the past several years, an increasing effort among scientists and engineers to utilize graphics processing units (GPUs) in a more general purpose fashion is allowing for previously unobtainable levels of computation by individual workstations. As data sets grow, the methods to work them grow at an equal, and often greater, pace. Certain common computations can take advantage of the massively parallel and optimized hardware constructs of the GPU which yield significant increases in performance. These common computations have high degrees of data parallelism, that is, they are the same computation applied to a large set of data where the result does not depend on other data elements. Image processing is one area were GPUs are being used to greatly increase the performance of certain analysis and visualization techniques.

Technical Methodology / Approach

Apply massively parallel algorithms and data structures to the specific analysis requirements presented when working with thermographic data sets

Benefits/Payoffs

The end product of this effort is a software package deliverable utilizing general purpose graphics processing units and high performance computing techniques that can be used in place of current commercial off the shelf thermographic inspection analysis and visualization software. This would also allow the use of previously unavailable computationally intensive analysis techniques, higher resolution thermographic cameras, and larger individual data files.

Customers

Customers for this project are entities involved in the development, fabrication, construction, and operation of aerospace structures and vehicles. Key customers include NASA and its contractors, other government agencies and contractors, as well as private industry. Potential projects include NASA's Space Launch System and commercial space efforts.

Accomplishments

2010

The focus for this period was the on the problem clarification, specifically, what hardware or software components were limiting factors in the analysis of large thermographic data sets. A literature survey was performed to determine what parallel algorithms could be implemented on the GPU to allow for increase analysis capabilities. Additionally, survey results yielded optimizations for the current CPU benchmarking implementation that will allow for future comparative results.

2011

The survey of available literature to determine the applicable algorithms, optimizations and techniques that can be applied to thermographic analysis and visualization was continued. A demonstration application was developed to directly benchmark the performance of various algorithms executed using the CPU and GPU (see figure 1). Planning has begun for the final deliverable, a software application capable of visualizing large sets of thermographic data.

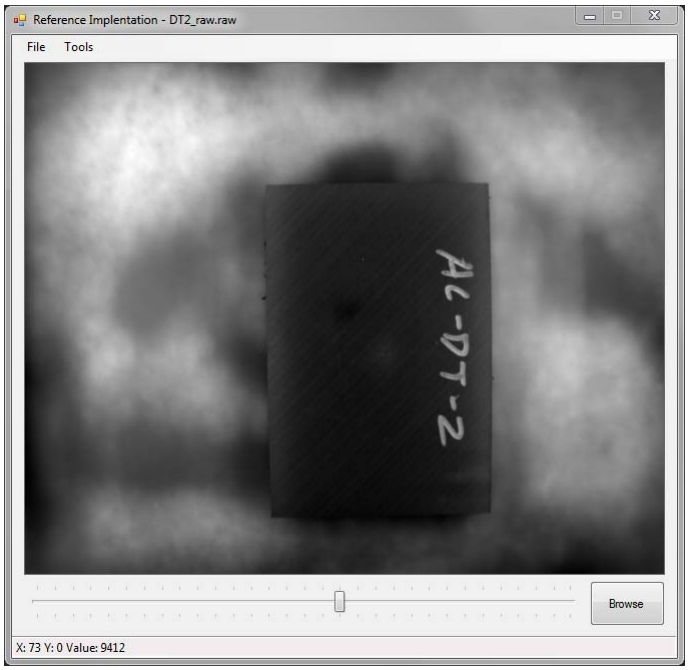

Figure 1

Future Work (2012)

During the final phase of the project, the software application deliverable will completed. A final report detailing the approach, methodology, and lessons learned on the project will be prepared. A one year augmentation proposal was submitted for consideration of an FY13 award. In this proposal, NASA MSFC and NASA LaRC will work with the University of Alabama Huntsville to expand the software application deliverable to include additional analysis and visualization capabilities that would be useful during a thermographic inspection.